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ABSTRACT

This book provides directions and sample activities to help parents teach their children to follow an easy system for study reading: set clear purposes for study; ask targeted questions; read quickly for specific information; summarize effectively; and gather information from charts and tables. The first section, Flexibility and Reading Speed, discusses basic procedures for study reading--the PARS Approach (purposes, ask, read, summarize). It also discusses notetaking and speed reading. The second section addresses following instructions and reading graphs and tables. Based on the self-directed learner philosophy, this book and the others in the series provide: essential comprehension techniques; basic vocabulary and phonics skills; clear guidelines for efficient study; critical thinking frameworks; and activities that lead to becoming a self-directed learner. Each book in the series also provides quick answers to pressing learning problems; easy practice activities for basic skills; common language explanations; and step-by-step guidance to engage children in active learning. (RS)

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HELPING CHILDREN TO LEARN SERIES

Reading To Learn

How To Study as You Read

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by Carl B. Smith

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Reading To Learn

How to Study as You Read

by Carl B. Smith

Clearinghouse on Reading, English and Communication

and

The Family Learning Association

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Introduction

Some educators think of the early grades as a time when children *learn to read;* later grades as a time when they *read to learn.* Probably a more helpful distinction is the difference between *reading for fun* and *reading for a purpose,* especially if the purpose is to learn something new.

Reading for fun has no rules. Each person decides what he or she likes and pursues individual interests. Novels, magazine articles, daily newspapers—read them all in personal style.

Reading to learn, however, flows from serious purposes. In school, the purpose may be to pass a test—deadly serious. At home and in the workplace, those purposes include:

- ✧ locating information quickly and clearly
- ✧ solving a problem
- ✧ building a knowledge base for any subject
- ✧ summarizing and reporting

Each reading-to-learn task requires its own set of skills. As children learn these skills, they become more effective learners; they perform better in school; they know how to succeed in workplace tasks. You can guide your children in learning these skills. This book provides the directions and sample activities to help you succeed in this important effort, thus benefiting your children enormously.

This book will help you teach your children how to do these things:

- ✧ Follow an easy system for study reading
- ✧ Set clear purposes for study
- ✧ Ask targeted questions
- ✧ Read quickly for specific information
- ✧ Summarize effectively
- ✧ Gather information from charts and tables

—Carl B. Smith
Director, Family Learning Association

Flexibility and Reading Speed

Once children get past the basic skills of reading, they will read all kinds of material for many different purposes: to get information, to enjoy an adventure, to pass a test, and so on. Help your child prepare for this by showing that he can apply basic reading skills to more complex tasks.

Children in the fourth or fifth grade should understand that they already have many of the skills they need to read a variety of books. Across the years they have developed a sense of order and of how things fit together and an appreciation of how to follow ideas to a conclusion. These skills are as useful in reading American history or science as they are in reading the simple stories of the early grades. Most children do not realize that they have developed many reading skills and habits over the years. Sometimes it's helpful to remind them that they have these skills which will help them read in content areas such as science or social studies.

By the time they get to fourth grade, children have seen a great variety of writing forms. Even a first grader has probably been given written instructions for making

simple things such as hand puppets or paper cutouts. These directions may have been illustrated to show each step. Pictures help young learners make the connection between spoken and written language. Early reading books also may include questions that help children focus on the text. Authors often use illustrations, questions, subheads, and similar techniques to clarify the text and to make it easier for a reader to follow the ideas. Proficient readers use those devices and also construct some of their own.

A Basic Procedure for Study Reading: The PARS Approach

Any job seems easier and more organized if we follow a procedure in doing it. For a younger student who is just beginning to find ways to tackle study reading, the four-step **PARS** approach provides a helpful way to organize the task. This approach involves the following steps:

- **P**urpose: Decide *why* you are reading.
- **A**sk: Constantly raise questions related to the purpose.
- **R**ead: Find answers to the questions you have raised.
- **S**ummarize: Write answers and record information in your own words.

Now we will look at each step in more detail.

Purpose

The first step in the PARS process is to decide *why* to read something. Most students are likely to say they are reading because they have to. Although this may be true about school work, it's not very helpful. A student has to get beyond this view and begin to ask, "What can I get out of reading this assignment?"

At first, your child will probably need help in figuring out her reasons for reading something. One way you can help is by describing your own reasons for choosing to read certain kinds of books. Why do you like those books? If you were the child, how would you expect to benefit from reading the assignment she's about to read? You can be a good role model for finding a purpose for reading. For example, you can show your child how to use chapter headings and subheadings to help focus the purpose. (For more on this particular technique, see the next section on asking questions.)

When your child is first learning to set a purpose for reading, you should encourage her to talk to herself about what she can see that is interesting or helpful in this article. Although it's best for young learners to come up with their own reading purpose, you should keep in mind that children are inexperienced at setting purposes and may need a little guidance at first.

For example, a young child may encounter a book entitled *The Magic Bunny.* Before reading, you can help the child think about a purpose just by asking questions such as, "What do you suppose a Magic Bunny is? What could it do that would be like magic?"

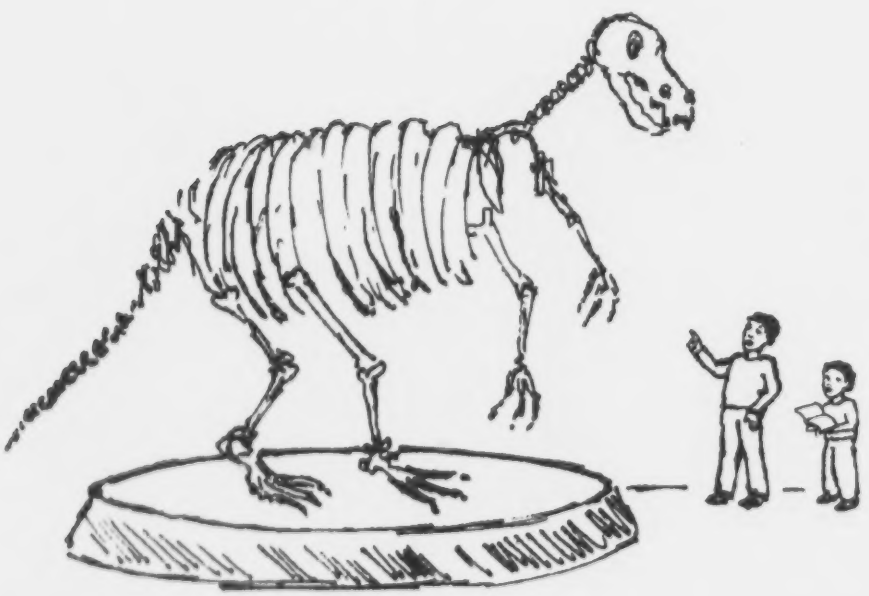
Of course, we really can't have any idea, but at least the child can come to realize that she is reading to find out "What *is* a Magic Bunny?" This is the purpose for reading: to find an answer to that question.

An older child may read a book entitled *What Happened to the Dinosaurs?* Of course, the title is a question itself, but your child should pay attention to it and realize that this sets a purpose for reading: to find out what happened to the dinosaurs. You can discuss this in advance by asking, "What do you already know about dinosaurs? Did you know they all disappeared long ago? What do *you* think might have happened?" Now your child is drawn into the book; it isn't just a pile of pages to be looked at.

One of the best ways to set a purpose is to have your child speculate and make predictions based on a book's title. For example, *The Mystery of Hidden Cove* suggests all sorts of questions and speculations. What is a *cove*? Where is it? What happened there? What makes it mysterious? Make sure your child knows that a cove is usually a small, sheltered inlet near a body of water. This leads to more speculation. What could happen in a cove? Could someone hide a small boat, or would they hide something valuable that they didn't want others to find? As you read along and discover that someone has in fact hidden a small boat filled with valuable jewels, let your child speculate some more. Who could have put them there? Where did they come from? How will they be found? Even if none of your child's predictions turn out to be accurate, they have still served a valuable purpose because they have gotten your child involved in a kind of conversation with the book.

When your child reads in content areas such as history or science, it is easy to overlook the most important purpose of all: to find out more about the subject. If the title of a section in a science book is "The Discovery of Radiation," the purpose is to find out what radiation is and when and how it was discovered. Remember that it is always helpful to turn titles and headings into questions which then set your purpose for reading: to find the answer to your questions. This is also valuable because it gets the child actively involved by thinking about her own questions and setting her own purpose before reading any of the text.

On the following pages you see a few guidelines that will help when your child is reading in various content areas. When appropriate, talk to your child about some of the purposes suggested on these pages.



Purposes for Reading in English

Literature

- ✧ To understand how others act and feel.
- ✧ To understand a way of life other than your own.
- ✧ To understand yourself better through the experiences of others.
- ✧ To extend your experiences beyond your present situation to other times and places.
- ✧ To understand different kinds of written expression such as poems, short stories, and plays.
- ✧ To find out how others have solved problems that might be similar to your own.

Writing

- ✧ To understand the basic units of written expression, such as sentences and paragraphs.
- ✧ To find ways of presenting thoughts and ideas in writing.
- ✧ To understand how others have organized and presented their ideas.
- ✧ To learn the standards of correctness and acceptable usage for putting words into written form so that others can understand them.

Purposes for Reading In the Social Sciences

History

- To understand how important events happened in the past.
- To understand how people have lived according to where they are in time and place.
- To learn about certain people who have had a large effect on the lives of others.
- To understand how past events have affected our present lives.
- To understand how history is being made today.

Contemporary Cultures

- To understand other societies and how people live in them.
- To compare our own way of life with that of others.
- To realize the problems faced by other societies.
- To understand how different cultures of the world are connected.

American Society

- To understand different institutions that affect every citizen's life.
- To learn how each of us can take part in public decisions.
- To understand the various subcultures within our society.
- To understand the values of our society.
- To understand the problems faced by the whole nation.

Purposes for Reading In the Sciences

Life Sciences

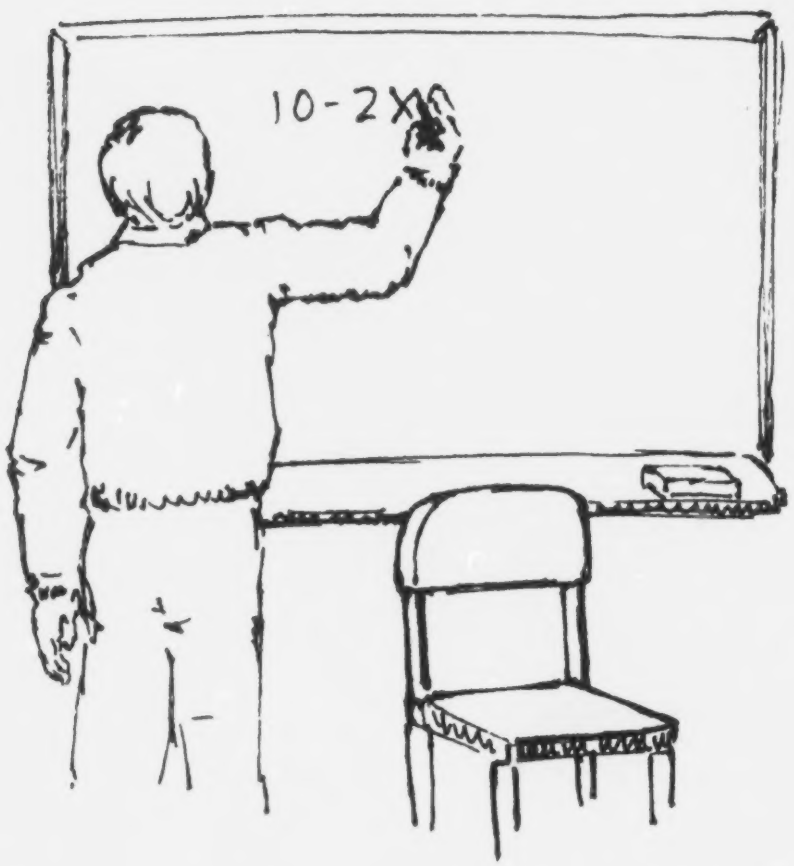
- To understand how different forms of life are part of an overall system.
- To appreciate the variety of kinds of life.
- To understand the relationships among different forms of life.
- To understand how changes affect the balance of nature.
- To understand man's role in the ecology of the earth.

Physical Sciences

- To understand the basic forces that act upon the world of living things.
- To learn basic laws that can be applied to our experiences.
- To understand how technology affects our lives.
- To go beyond how things appear to a more complete understanding made possible only through science.

Purposes for Reading In Mathematics

- ✧ To learn mathematical operations.
- ✧ To learn how to solve problems.
- ✧ To learn how to apply mathematical principles.
- ✧ To learn the special "language" of mathematics, such as tables and graphs and the calculator.



Ask

The next step in the PARS approach is to *ask questions.* We already mentioned that questions can be used to help set a purpose for reading: What will I learn about this subject? However, after you have set a general purpose, it is important to keep asking more and more detailed questions that relate to the purpose your child has set for reading. As she glances ahead at the text, what does she want to learn? What is she curious about? How will she know that she is making satisfactory progress in this text?

A good reader is always asking questions. Encourage your child to think of these questions as road signs, telling where she's going and whether she has gotten there. For almost any piece of writing, it's possible to ask about the author's purpose in writing, about the accuracy of the information, the main ideas, conclusions, and the evidence. Here are some sample questions a reader might ask about any reading that deals with content areas such as social studies or history or science:

- What was the author's purpose for writing this?
- What are the main ideas here?
- What claims is the writer making?
- What evidence is given to back up the author's claims?
- Which facts are most important?
- What does the writer conclude from the facts?

- ✧ Do the facts back up what the author is saying?
- ✧ From where do these facts come?

One source of questions can be found in headings and subheads. As your child previews a chapter, encourage her to turn some chapter headings and subheads into questions. One of the best ways to do this is to use words such as *Why* and *How* and *What* and *Who* at the beginning of each question. For example, if a heading says *All machines waste energy*, the obvious questions are, ***Why*** *do all machines waste energy?* and ***How*** *does this happen?* These questions give you a clear purpose for reading: to find an answer.

See if your child can make questions of the following headings. (Some suggestions are given in parentheses after each one.)

- ■ *Religion influenced medieval thought about the universe*

(*How* did religion influence medieval thought about the universe? *What* were the beliefs at that time about the universe?)

- ■ *European history affects certain trends*

(*What* were these trends? *How* did European history affect them? Exactly *what* is the connection between events in history and the trends discussed?)

- *Internal combustion engines*
  (*What* are internal combustion engines? *How* do they work? *Who* invented them? *How* did they develop?)

- *Building a unified paragraph*
  (*What* is a unified paragraph? *What* makes it unified? *How* do I write one?)

- *Arctic exploration*
  (*When* was the Arctic first explored? *Who* explored it? *How* did they do it?)

- *Amphibious animals*
  (*What* does the word *amphibious* mean? *What* makes an animal amphibious? *How* did amphibious animals develop?)

As you see, even a short heading such as *Amphibious Animals* can generate a whole series of questions that direct our reading as we look for answers. Once your child realizes that headings can carry meaning and can lead to questions about the reading, you can point to illustrations, boldface words, and chapter summaries as other sources to stimulate advance questions.

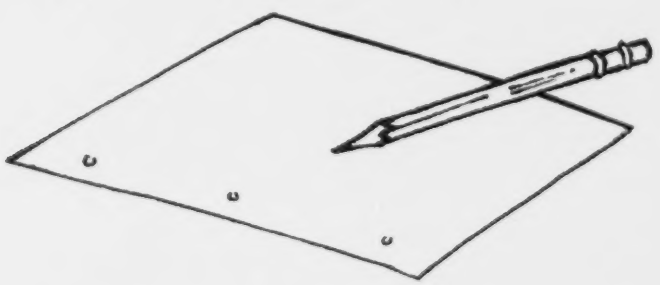
One other point should be mentioned here. A good way to read actively and to raise questions as you go along is to *take notes.* This means that your child should jot down questions so that they can be followed up later. We will talk more about taking notes in just a moment.

Read

Once your child sets a purpose and asks himself questions about what he's about to read, he is ready to begin reading. He now has a plan for taking in information and ideas. By following the plan, he will be more active and positive than if he had just started reading with no clear direction. Having a structure laid out in advance encourages your child to remember and to build meaning as he goes.

While reading, your child should talk to himself about what he is learning, about the things that are not clear, about ways to answer the questions he raised earlier. This can be done by *taking notes*, which is another way to be an active reader and to see whether or not questions were answered. It is also helpful to jot down important terms and ideas while reading. This will be discussed more fully a little later.

When we read a novel, a letter, a newspaper, or a recipe, we fit the information to our own interests and needs with little or no conscious effort. Study reading takes a bit more planning. Work with your child until he learns to map out an approach to study reading. You may even find that the planning leads your young learner to prepare for a reading task with paper, pencil, reference books, and singular concentration.



Summarize

Learning becomes fixed in a child's mind when that child is able to put ideas into his own words. This is what we mean by *summarizing*, which is the final step in the PARS process. After completing a well-planned reading task, help your child wrap it all up by saying how the purpose that he set for the reading has been achieved, and how his questions can be answered. He should be able to tell what the main ideas are, what they mean to him, and how he would give someone else a bird's-eye view of what he learned.

The form that reading material takes on in our minds as we read it is the summary. It is helpful for a learner to write a summary of two or three sentences as a way to bring the work to a satisfactory conclusion and as a means for recalling the important ideas—perhaps as a review for a test.

Here is a reminder of the steps involved in the study-reading procedure we have been discussing:

P A R S Technique

P Set a purpose for reading. Make it relevant.
A Ask questions about the text. These questions will guide your thinking as you read.
R Read with purpose and questions in mind; that is, with a sense of how you will use the information.
S Summarize in your own words what you have read.

Taking Notes

We have already mentioned the value of writing down questions and important terms when your child is first reading a passage. This process of taking notes is necessary because no one can remember everything after only one reading. Furthermore, it is not helpful to try to remember every detail. Notes give you a way to keep track of the big questions and the most significant terms and ideas; then your child can focus on learning and understanding the important things.

For younger children, the procedure for taking notes should be as simple as possible. One way to take notes is to place a piece of paper along the margin of each page in the book, with the book's page number marked on the notepaper. Then your child can write down a question or term on the notepaper as it appears in the book. Later, the note pages will show important new words that can be looked up in the glossary. They can be also used for review or more extensive study.

Older children may want to use a kind of outline form when it is appropriate. An outline can look like this:

MAIN TOPIC 1 (page number in book)
- First important idea within this topic
- Important terms
- Second important idea
  - Important terms (etc.)

MAIN TOPIC 2
- First important idea
  - Important terms (etc.)

And so on, with as many sections as you need for each situation. On your notepaper, always record the page number in the book so you can go back later for review.

Learning to Read More Efficiently

There will be times when your child has to read large amounts of material in order to answer a few questions. She may be doing research for a paper, trying to find certain kinds of stories in a newspaper, or answering questions to an open-book test. Your child needs to apply what is known as "efficiency reading" to handle these kinds of tasks.

In efficiency reading, the aim is to read as quickly as possible for a specific purpose. It's based on the idea that we can read something several times faster than usual and still pick up the basic meaning. Some speed-reading programs claim that a person can learn to read as fast as he can turn the page. While this may seem a little hard to believe, high school and college students have been proven able to read from 1000 to 5000 words per minute in certain situations.

Speed-Reading

Speed-reading (or page thinking) can be helpful for a typical school assignment because it enables a person to read material twice in the same amount of time it would normally take to read it once. The first time through, the reading can serve as a sort of preview for the second time. Also, speed-reading allows a student to review a previous assignment quickly just before a class discussion or test.

Speed-reading is a deliberate attempt to read faster by using only enough cues to think about the ideas on a page. The reader forces herself to move faster and faster and asks herself what ideas are developing rather than focusing on saying every word.

Even a child in elementary school can learn to read faster simply by using the index finger as a guide. When practicing, the child can gradually increase how fast the finger leads the eye across the page.

Skimming

Skimming is not the same as speed-reading. In skimming, the goal is usually to pick out specific ideas, whether they are main themes, certain details, or important words. A reader might also skim to find out if a piece of writing fits her purpose or if it is worthwhile to spend time reading more closely. Not only children practice skimming; adults skim when they look over materials to set work priorities, decide on responding to correspondence, browse at the library, and so on.

Whether a person is speed-reading or skimming, the principle is the same: moving faster than normal and understanding what is read at the higher speeds. Once a person can take in what she reads more quickly, she needs to practice reading at an even faster rate. To convert speed-reading into skimming, the reader only needs to keep in mind that she is looking for certain items in the text and not trying to grasp all the important details.

Developing Skills in Speed-Reading and Skimming

You can help your child practice speed-reading and skimming. These techniques can make a difference even if they are practiced for only a few minutes each week. It's easy to tell how fast your child reads. Give her a page or two to read and clock how long it takes in words per minutes. For children in the later grades of elementary school, you should start with passages of no more than 1000 words. However, as the reading speed increases, you can use longer readings. Here's the formula for figuring out reading speed:

$$\frac{\text{words read}}{\text{time in seconds}} \times 60 = \text{average words per minute}$$

(Number of words in the passage, divided by the number of seconds it took to read it, times 60 equals reading speed in words per minute.)

Of course, it is most important for your child to *understand* what she is reading. To make sure that she is getting meaning as her reading speed increases, ask questions about the reading material or have her sum-

marize what she has read. As you keep track of the reading speed, you can also record the "comprehension score" (how many questions about the reading were answered correctly). Use a standard number of questions each time so that the comprehension scores will be comparable to each other. A table like the one given below can be used for tracking progress is increased speed. You can use this table as a way of prompting your child to improve speed and comprehension.

RATE RECORD

Date	Passage Description	Words Per Minute	Comprehension Score
____	_____	_____	_____
____	_____	_____	_____

Encourage your child to practice skimming by looking for specific bits of information in a passage. Find an article and give your child two or three tasks to finish within a limited time. In an article about the history of manned space flight, for instance, you might say, "Let's see how long it takes you to find the year when the first jet-propelled airplane flew," or "Find the names of as many pioneers of flight as you can, and tell why each one is important." Then let your child know how many seconds it took her to report back. This kind of drill will make a game of finding information as quickly as possible. Then your child may ask how she can improve her skimming techniques. Success with these drills will build your child's confidence in her reading ability and will help her learn how to adjust reading to a purpose.

You and your child can use the following checklist to review the skills needed for efficiency reading.

Efficiency Reading Checklist

	not sure	never	some-times	usually	always
1. I can read fast and understand what I read.					
2. When reading quickly, I look for main ideas.					
3. Before reading, I preview to see how fast I should read.					
4. I change reading speed depending on what I'm reading.					
5. I skim when looking for a single fact or other item.					
6. When skimming, I try to get meaning from context.					
7. I read silently without saying the words.					
8. I read groups of words rather than one word at a time.					
9. I do not look back at what I've already read.					
10. I try to keep increasing my rapid-reading speed.					

Summary

✧ Your child can apply the skills of basic reading in studying other subjects.

✧ Chapter headings and subheadings can help us form questions about what we intend to read.

✧ Using the PARS study-reading method can make a learner's study efforts more effective.

✧ Speed-reading and skimming can help us get more out of reading.

Following Instructions and Reading Graphs and Tables

Most children have difficulties with schoolwork at one time or another. This is not because they don't understand or are slow learners but because they don't pay close attention to instructions. This is especially true in math and science. Any set of directions must be listened to or read carefully, and children have to realize that it can cause problems if they are careless or jump to conclusions. Especially when the instructions are spoken, it's important to make sure they are understood before answering a question or doing a task. Of course, written instructions can be read more than once, but it's best for children to develop the habit of carefully reading what they are being asked before reacting.

Children will be following directions throughout their lives. That's why they must acquire an early appreciation of the need for care and accuracy in dealing with instructions. In the next few pages you will find several simple exercises designed to help young children practice following both spoken and written instructions. The skills needed in these first drills can be applied to the later sections of this chapter involving graphs, maps, and tables.

Following spoken directions

If yours is a very young child who's reading and writing skills are not very advanced, she can begin to practice complying with spoken directions. Start with simple, one-step procedures requiring the child to react to just one direction before moving to the next exercise. There's no limit to the tasks you could assign. Here are some examples:

- ✧ Clap your hands twice.
- ✧ Raise your right hand above your head.
- ✧ Turn around in a circle.
- ✧ Hold up three fingers on your left hand.

Once your child understands the importance of listening to each direction before acting on it, you can go on to two-step instructions. Here again, you should stress that it's critical to listen carefully to the entire set of directions before acting. You can combine the previous instructions, or add new ones:

- ✧ Clap your hands once, and then tap your right foot once.
- ✧ Raise your right hand over your head, and then point to the floor with your left hand.
- ✧ Draw a circle in the air with your right hand, and then hold up three fingers on your left hand.

You can proceed to instructions that include three or four steps as long as the responses required are fairly simple. You may want to have several children participate in these activities by turning them into the "Mother, may I?" game. Before doing the tasks, the child asks,

"Mother, may I?" "Yes, you may." Upon successful completion of the tasks, the child advances on a course or receives a point on a score sheet.

It's also good practice to give verbal instructions that require your child to write or draw on paper. You can offer directions in which the first step leads to the second, and so on. The following are examples of three-step instructions.

Provide paper and brown, red, and yellow crayons.

1. Draw an ice cream cone on the left side of the page, a balloon in the center of the page, and a banana on the right side of the page. (Wait for the child to complete all of this before continuing.)

2. Color the ice cream brown, the balloon red, and the banana yellow.

3. Write your name in the top right corner of the page, put the date under your name, and then hold up the paper for everyone to see.

These exercises are organized in such a way that the amount of information in the instructions increases. This means that your child has to listen carefully and retain the information before acting.

Following written directions

As was true for following spoken instructions, it's a good idea to start very young children with written directions that involve only one step before moving to more complicated exercises. The difference here is that a child must be advanced enough in reading to be able to understand and comply with written instructions. It's best to begin with examples that pose simple tasks.

Instructions such as those given below can be written on cards or on the top of the paper on which the answers will be written. For the sake of variety, you may include exercises calling for physical acts. You may also use the example directions given in the section on following spoken instructions, but keep in mind the limits of your child's vocabulary and reading skills. Here are a few samples using simple words:

- Tap your foot three times.
- Draw two circles and one box.
- Write your name with a red crayon and circle it in yellow.

Second graders usually are able to handle written instructions involving three steps. Most of the examples below have three steps; they can be adapted to two- or four-step drills as needed. For those exercises requiring the drawing of various shapes, you may want to review how a circle, square, and triangle are shaped. Be sure to stress that only by reading the directions carefully and completely will the child be able to plan the placement of the various shapes on the page.

The following exercises require only paper and red, yellow, and blue crayons. The illustrations are for your information; your child should see only the written instructions.

- ✧ Draw a yellow triangle. Draw a red circle to the right of the yellow triangle. Then put a blue square to the right of the circle.

- ✧ Draw a blue circle. Put a red triangle inside the circle. Draw a yellow square to the right of the circle.

More complicated tasks can be given to older children. For example, "Draw a red square; put a circle around the square; make a blue triangle inside the square;" and so on.

You can come up with other exercises that require your child to deal with words or to write answers. For these, only pencil and paper are needed.

✧ Look at each group of words given below. Which word in each group is different from the others? Draw a line under the one that is different.

kitten kitten kittens kitten

house horse house house

run run ran run

play ply play play

✧ Look at the words in each group. Draw a line under the words that go with the first word. Put two lines under the word that does not go with the first word.

baseball bat game bark

lake water grass boat

house door window sky

school book desk boat

✧ Write your name on your paper. Write your age under your name. Draw a big circle around your age and name.

It is possible to create other activities that fit the needs and abilities of your own child. An older child can be given more challenging projects that require him to find pictures or information in magazines or newspapers and to act on them.

For example:

- Look at the front page of the newspaper. Find two different stories and read the headline and the first few lines of each one. Write the key word or words that tell what the story is about.

Your goal in all of these exercises should be to offer a clear set of directions, giving the child practice in reading instructions carefully before trying to follow them.

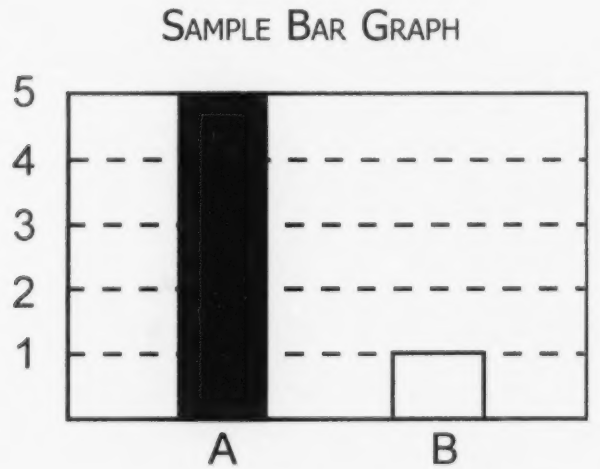
Graphs, maps, and tables

A graph is a kind of diagram used to represent information in a clear, concise form. Graphs are especially useful in simplifying large amounts of information or in displaying how two or more things are connected or related. Because graphs do both of these things well, they are used quite often even though they don't always give details as completely as tables do.

There are four basic kinds of graphs: bar, line, circle, and picture. Often one kind will be better suited than the others to displaying a particular kind of fact. This will become more obvious as we discuss the types of graphs in more detail.

✧ Bar graphs

Bar graphs are often used to compare two or more sets of amounts. In a bar graph, amounts are compared by using heavy lines ("bars") which are drawn to scale; that is, in proportion to each other. For example, if amount ***A*** is five times greater than amount ***B***, the bar that stands for ***A*** will be five times longer than the bar that stands for ***B***.



Your child will be better able to understand why bar graphs are made and how to understand them if you help him make his own bar graphs. Here are the steps involved; some examples follow.

How to make a bar graph

(1) Decide what type of information you want represented on the graph. At first, it's a good idea to choose familiar items that can be easily counted and which have some meaning to your child. For example, you could use a bar graph to show how many chairs, lamps, tables, and beds there are in your home.

(2) Figure out a scale, depending on the space available. Decide how much space you want the largest bar to occupy and then make the other bars proportionally smaller. If very large numbers are represented on the page, a very small part of the page can stand for a large amount (one inch may represent a thousand miles, for example).

(3) Find the actual length of each bar, based on the scale you've set up. Draw the bars carefully to make sure each is the right length. The graph should be labeled clearly to show what is represented.

Bars can be laid out vertically (up and down) or horizontally (across), and background lines can be included if they make the graph clearer.

We'll set up a bar graph based on the information in the following example.

The children in Mrs. Jones' third-grade class have the following pets:

9 cats	5 mice
10 dogs	3 birds

Set up a bar graph with this information.

(1) The scale used here will be one animal equals 1/2 inch. That means the longest bar will be five inches long (since 10 dogs x 1/2 inch = 5 inches).

(2) Find the length of each bar, according to the same scale: 10 dogs = 5 inches; 9 cats = 4 1/2 inches; 5 mice = 2 1/2 inches; and 3 birds = 1 1/2 inches.

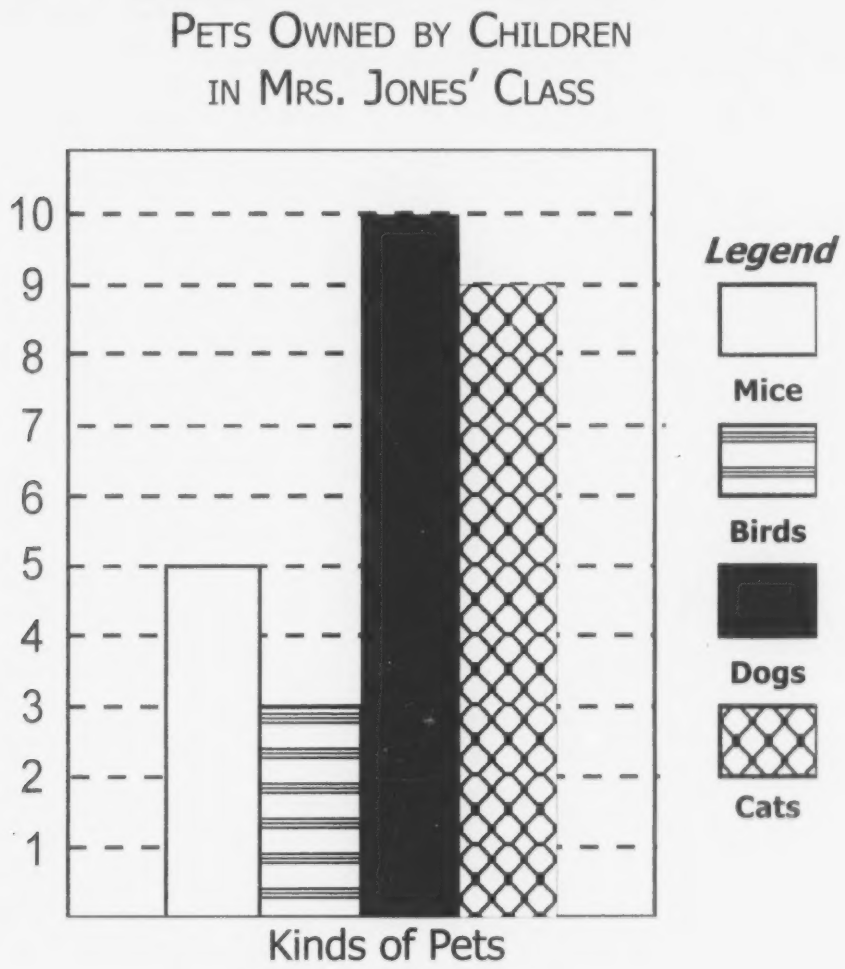
(3) Draw a solid line across the paper, near the middle of the page. This will serve as a reference point (that is, zero). Lightly draw lines parallel to this one, 1/2 inch apart. Draw at least ten of these (to represent ten half-inch segments), and number these from the bottom to the top, along the left side of the page.

(4) Make vertical bars to represent each of the four kinds of pets. You can make the bars as thick or thin as you want.

(5) Under each bar, label the kind of animal it represents. Or you may label the animals in a legend (see example).

(6) Give the graph a title that explains it, such as "Pets Owned by Children in Mrs. Jones' Class."

The finished graph should look something like this:

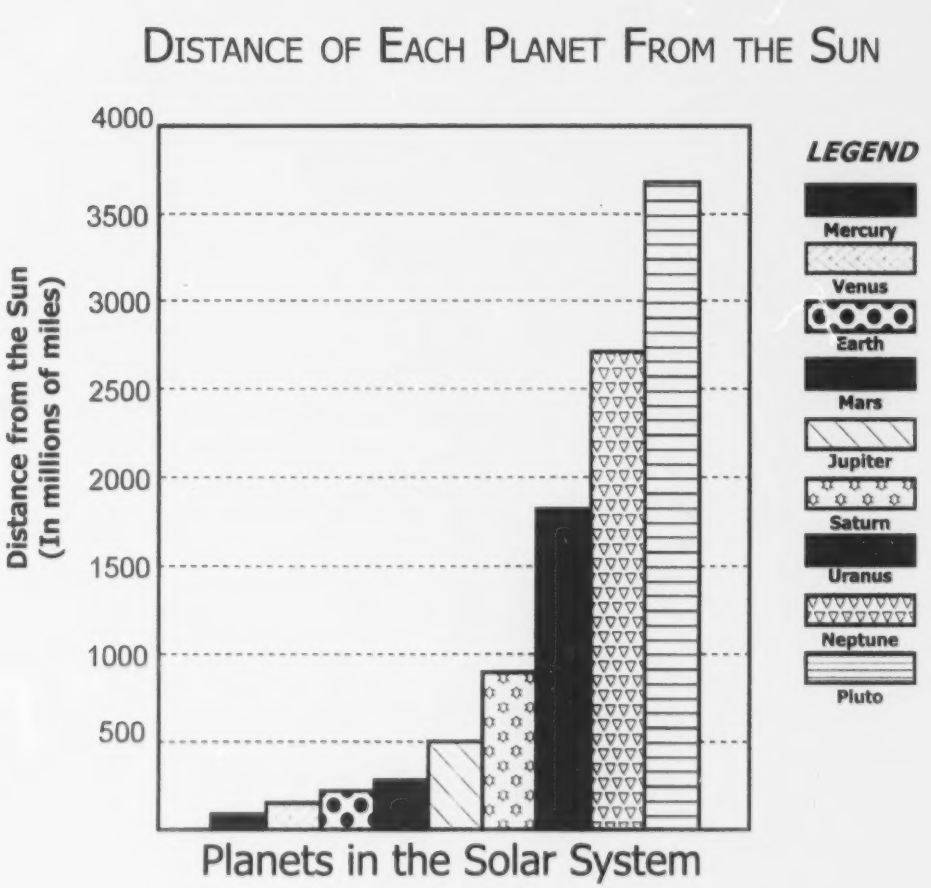


Once you make the basic graph, you have some choices as to how you finish the picture. Your child can color in the graph or leave it blank. The background lines are also optional, but they help make it clear how many items (in our example, pets) are represented. Without the background lines we can see that there are more dogs than cats, mice, or birds, but it's harder to tell how many of each there are.

Older children can work with more complex graphs that compare a number of items. Here is an example.

✧ Distance of planets from the sun

In the graph on the next page, you can see how far each of the planets in our solar system is from the sun. Each number represents millions of miles, so each amount would be followed by six zeros (for example 250 million = 250,000,000). After your child studies the graph, ask the questions that follow. Obviously, when dealing with such enormous numbers it is not possible to represent exact amounts accurately on a bar graph. However, the graph does get across the idea of how many times farther away from the sun is Pluto than Earth, Venus, or Mercury. Simply giving a young child the exact numbers would not be as meaningful as showing how the distances relate to each other.



(1) Which planet is nearly 500 million miles away from the sun? (Jupiter)

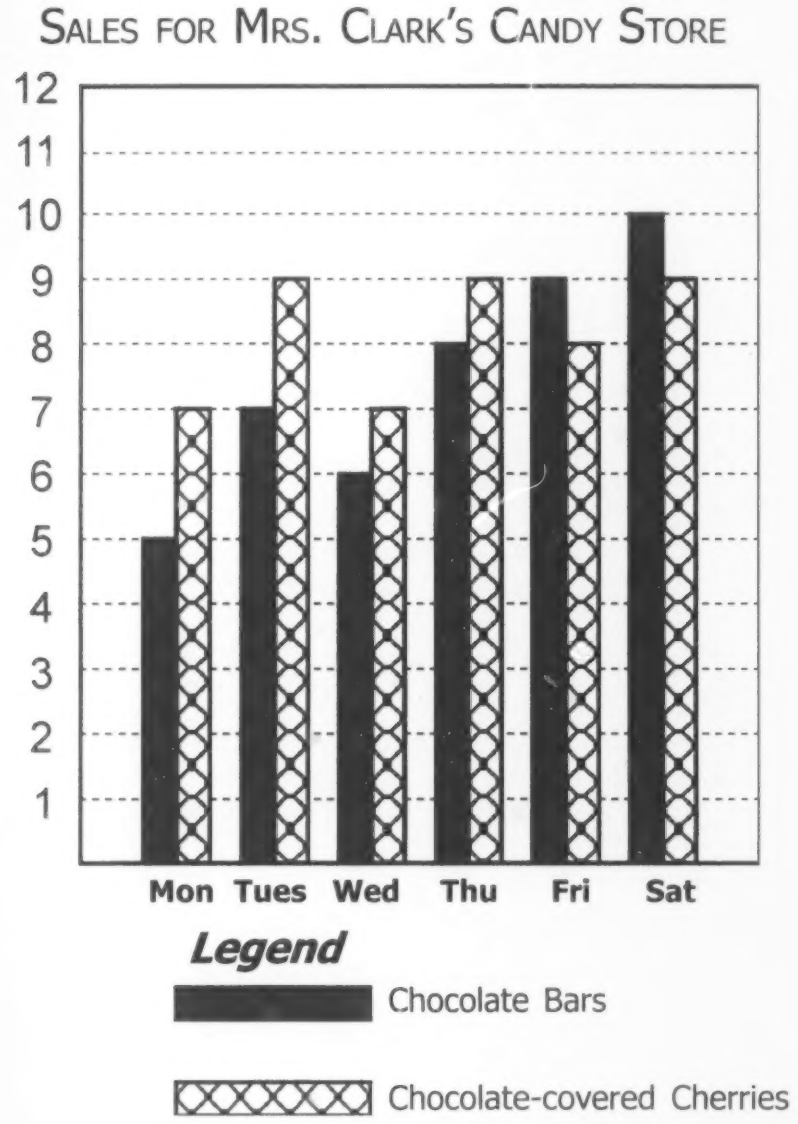
(2) How many planets are more than 500 million miles away from the sun, and what are their names? (Four planets are more than 500 million miles away; they are Saturn, Uranus, Neptune and Pluto.)

(3) Which two planets are farthest from the sun? (Pluto is farthest away, followed by Neptune.)

(4) Which planet is closest to the sun? (Mercury)

✧ Double bar graphs

Even greater comparisons can be made if the bars are drawn in pairs, with each bar representing a different thing. Help your child look at the following graph and answer the questions about one week's worth of sales of chocolate-covered cherries and chocolate bars. The key or "legend" at the bottom of the graph explains which bar represents which kind of candy.



(1) What was the total number of chocolate bars sold on Tuesday, Wednesday, and Thursday put together? (21)

(2) How many boxes of cherries were sold on Thursday, Friday, and Saturday combined? (26)

(3) On which days were the most boxes of cherries sold? (Nine boxes were sold on Tuesday, Thursday, and again on Saturday.)

(4) What was the total number of boxes of candy sold over the whole week, counting both kinds of candy together? (94)

It is also possible to use **triple bar graphs** to compare amounts of three different things. Graphs comparing more than three sets of items can become confusing and probably should not be used with younger students.

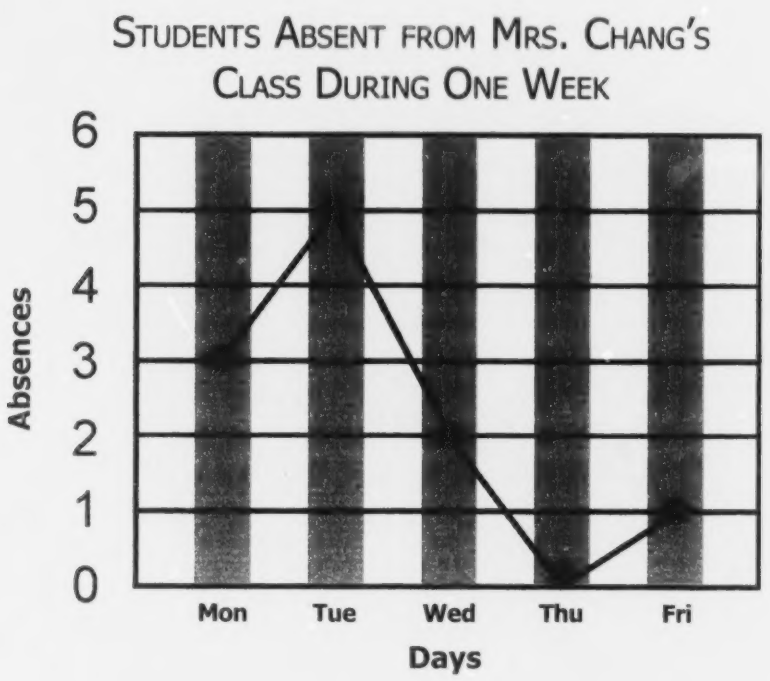
✧ Line graphs

Line graphs (also called broken-line graphs) are used to show how changes in one variable relate to one or more other variables. Usually one of the variables, such as time or distance, is continuous. We can use this kind of graph, for example, to show how the amount of power used in a city changes over the course of a day.

To set up a broken-line graph for this situation, we first have to establish a scale. As with the bar graphs, one variable is laid out horizontally and the other is presented vertically. Time is normally placed horizontally along the bottom of the graph. Once the scales have been drawn and labeled, points can be put on the graph to represent the given facts. The points are then joined, creating the line. It is possible for the resulting line to be straight, but most often it has a jagged appearance. That's why it's called a "broken-line graph."

School absences

Go over the next graph with your child and ask the questions that come after it. Mrs. Chang kept a record of the absences in her class during one week. She put the numbers into a graph, with the vertical blocks showing the number of absences and the horizontal lines representing the days of the week.



(1) On which two days were the most children absent from class? (Monday and Tuesday)

(2) On what day were there no absences? (Thursday)

(3) What was the largest number of absences in one day, and on which day was it? (Five, on Tuesday)

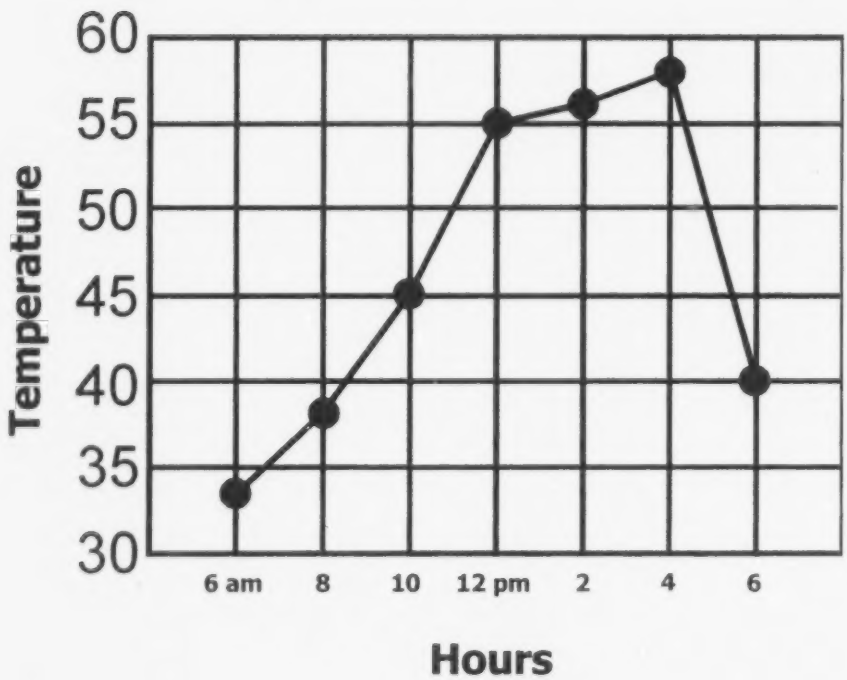
(4) Were there more students absent on Monday or Wednesday? (Monday)

(5) Did more of the absent children return to school on Wednesday or Thursday? (Wednesday)

Temperature changes

Here is a more complex line graph that represents changes in temperature over a 12-hour period. The outdoor temperature was checked every two hours between six a.m. and six p.m. The numbers were put on a grid on which each horizontal line represents an increase of five degrees, starting at the bottom with 30 degrees. Two-hour periods are labeled across the bottom of the graph. Study the graph and answer the questions.

TEMPERATURE CHANGES OVER 12 HOURS



(1) What was the temperature at noon? (55 degrees)

(2) During the morning, did the temperature go up or down? (Up)

(3) By how many degrees did the temperature change between 8 and 10 a.m.? (It increased 7 degrees.)

(4) What were the highest and lowest temperatures? (The highest was 58 at 4 p.m.; the lowest was 34 at 6 a.m.)

(5) During which two-hour period did the temperature change the most? (The temperature fell 18 degrees between 4 and 6 p.m.)

✧ Circle graphs

The circle graph, also called a "pie chart," is a convenient way of showing how parts of something make up the whole (or how the "slices" fit together to make the whole "pie").

When they learn how to tell time, children usually become familiar with a clock face and can understand the division of a circle into halves, thirds, fourths, sixths and even twelfths. In fact, working with circle graphs can help them understand how clocks divide the day into parts: hours, half-hours, minutes, and so on.

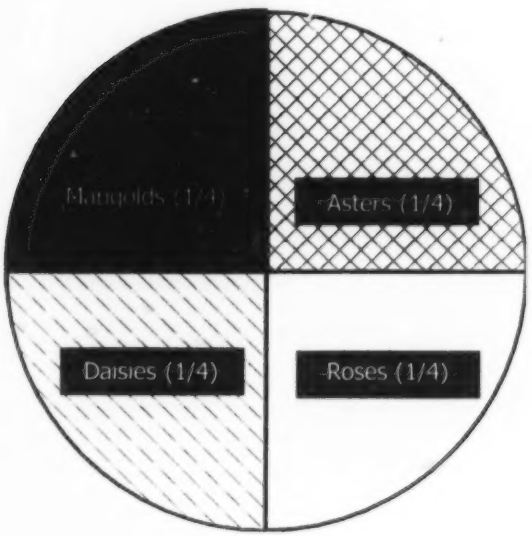
A good way to help children understand circle graphs is to make circular cutouts and fold them. Fold the cutout over once to show what a half-circle looks like, fold it again to show a quarter-circle, and once more to make an eighth. This will help your child learn not only circle graphs but also fractions, just as understanding fractions will make circle graphs easier.

Here is a simple example that can show younger children how circle graphs work.

Mrs. Smith's flower garden

Mrs. Smith planted a flower garden, represented by the circle below. Each section of the circle stands for a different kind of flower that she planted. After studying the graph, answer the following questions.

Mrs. Smith's Flower Garden



(1) How many different kinds of flowers did Mrs. Smith plant? (Four)

(2) Did she plant more of any one kind than the others? (No)

(3) How much of the garden is taken up by roses and marigolds put together? (Half)

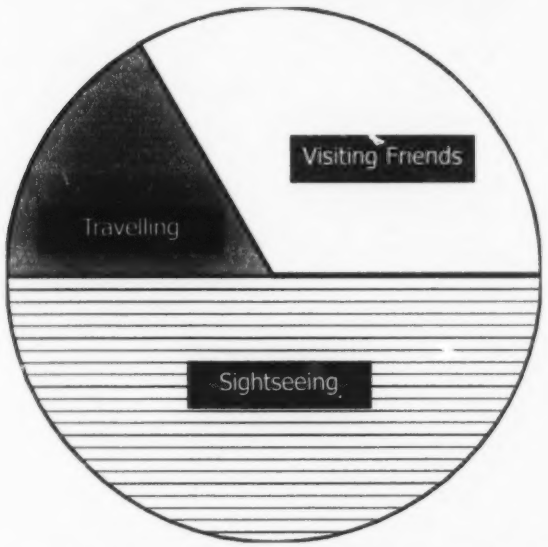
(4) If Mrs. Smith picks half the daisies, how much of the garden will be left with no flowers blooming? (One-eighth)

(5) Altogether, Mrs. Smith paid two dollars for all the seeds in her garden. If each kind of seed costs the same amount, how much did she pay for the aster seeds? (50 cents)

The Jones family vacation

The Jones family spent a 12-day vacation traveling by car, visiting friends, and sightseeing in New York. This circle graph shows how the 12 days were spent.

THE JONES FAMILY VACATION



(1) One-sixth of the time was spent traveling. How many days is that? (Two)

(2) How many days were spent sightseeing? (Six)

(3) How much of the graph shows the amount of time spent visiting friends? (One-third) How many days is that? (Four)

(4) If the Jones family had spent one more of the 12 days traveling, how much of the graph would show the time the family traveled? (One-fourth, which means three days) If the Joneses still wanted to spend the same amount of time in New York, how much time would be left to visit friends? (Three days)

Picture graphs (pictographs or pictograms)

Sometimes, graphs use pictures of the things being represented to show how many of the things there are. When there are not many items being counted, one picture can stand for one thing. In the first bar graph we looked at, for example, a separate picture could be used to represent each animal since there are only ten dogs, nine cats, five mice and three birds owned by the children in the class.

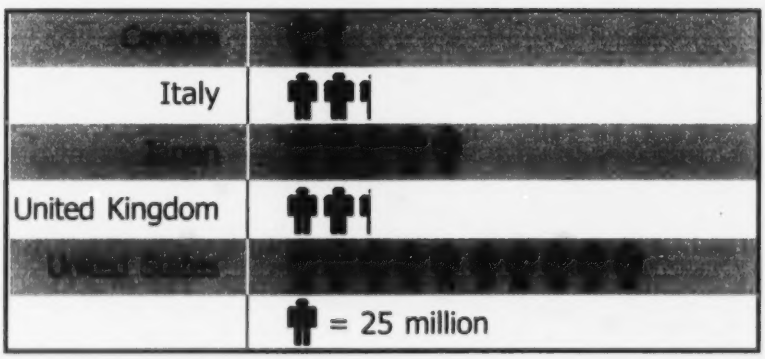
If large numbers have to be shown, then one picture can stand for dozens, hundreds, or even billions of things. For instance, if we wanted to make a picture graph of how many cars go through a busy intersection in a certain amount of time, there may be so many that one picture of a car may have to stand for a hundred or even a thousand cars. As with any other kind of graph, when a very large number is represented, the amount shown in the picture graph may just round off the actual total.

To understand how to read different kinds of graphs, a child must understand what the word *scale* means. It has different meanings in different kinds of graphs. In a picture graph, *scale* means how many things the picture portrays, while in a map (which is another kind of graph), *scale* refers to how much of the map stands for how much real distance. This is why a road map may say, for example, "one inch equals 50 miles." Notice what each picture represents in the following example.

1990 population for selected countries

This picture graph shows the number of people who lived in Canada, Italy, Japan, the United Kingdom, and the United States in 1990. As you see at the bottom of the graph, each stick figure stands for 25 million people (25,000,000). Because the numbers are so big, they've been rounded off to the nearest million. With this kind of graph, we can see which countries have about the same number of people living in them, which have the most, and which have the least. The graph also gets across the idea of millions of people better than just the numbers.

POPULATION GRAPH



(1) Which of these countries had the largest population? (USA)

(2) Since there are ten whole stick figures to stand for the number of the people in the United States, about how many people were there in 1990? (250 million)

(3) Which of these countries had the second largest population, and about how many people were there? (Japan is second; the almost five stick figures represent close to 125 million people. There were actually 124 million people in Japan in 1990.)

(4) Which two countries had about the same number of people in them, and about how many people were there? (Italy and the United Kingdom each have almost 2 1/2 stick figures in their rows, so they each had between 55 and 60 million people in 1990. Italy really had 58 million and the United Kingdom had 57 million.)

(5) Which of the countries shown had the fewest people, and how many people lived there? (The population of Canada is represented by just over one stick figure, which means that about 25 million people lived there. The real figure in 1990 was 27 million.)

(6) Think about how the country with the largest population compared to the one with the smallest. Which two countries were those, and how many times more people were there in the biggest country than in the smallest? (There were almost ten times as many people living in the United States as in Canada.)

(7) How does the number of people in the United States compare to the number in the country with the next largest population? (There were just over twice as many people in the United States as there were in the country with the second largest population, Japan.)

Maps

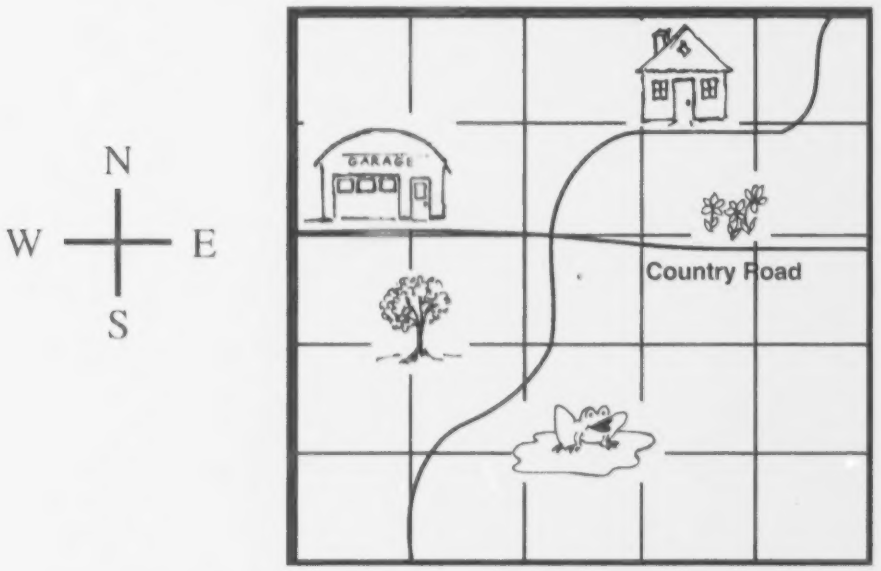
A map is a special kind of graph. It is a picture of an area drawn to a certain scale. We can use a map to show the whole world, a single country, one city block, or even the inside of one house. Maps are of course a lot smaller than the area they represent, but the distances between things on the map should be in proportion to the distances they portray. This is what we mean when we say a map has to be drawn "to scale."

Maps don't need to show every single detail, as a photograph would. Instead, they only have to include some of the most important features in an area. A geographical map shows mountains, valleys, rivers, and so on; political maps show the boundaries between states or countries, where cities are, etc.; other maps can show such information as election results, population comparisons, or other facts.

There are many excellent atlases (books of maps) and other books that include maps for young children. If your child is interested in this kind of material, you can check your local library or bookstore to see what's available from major map publishers such as Rand McNally and Co. or C. S. Hammond and Co. These books have many illustrations as well as plenty of information along with the maps; they often include other kinds of graphs and tables.

Map of Jim's neighborhood

We'll begin with a drawing that shows a few major landmarks near a country road where Jim lives. In the picture, you can see that the pond is south of Jim's house, the gas station is to the west, and so on.

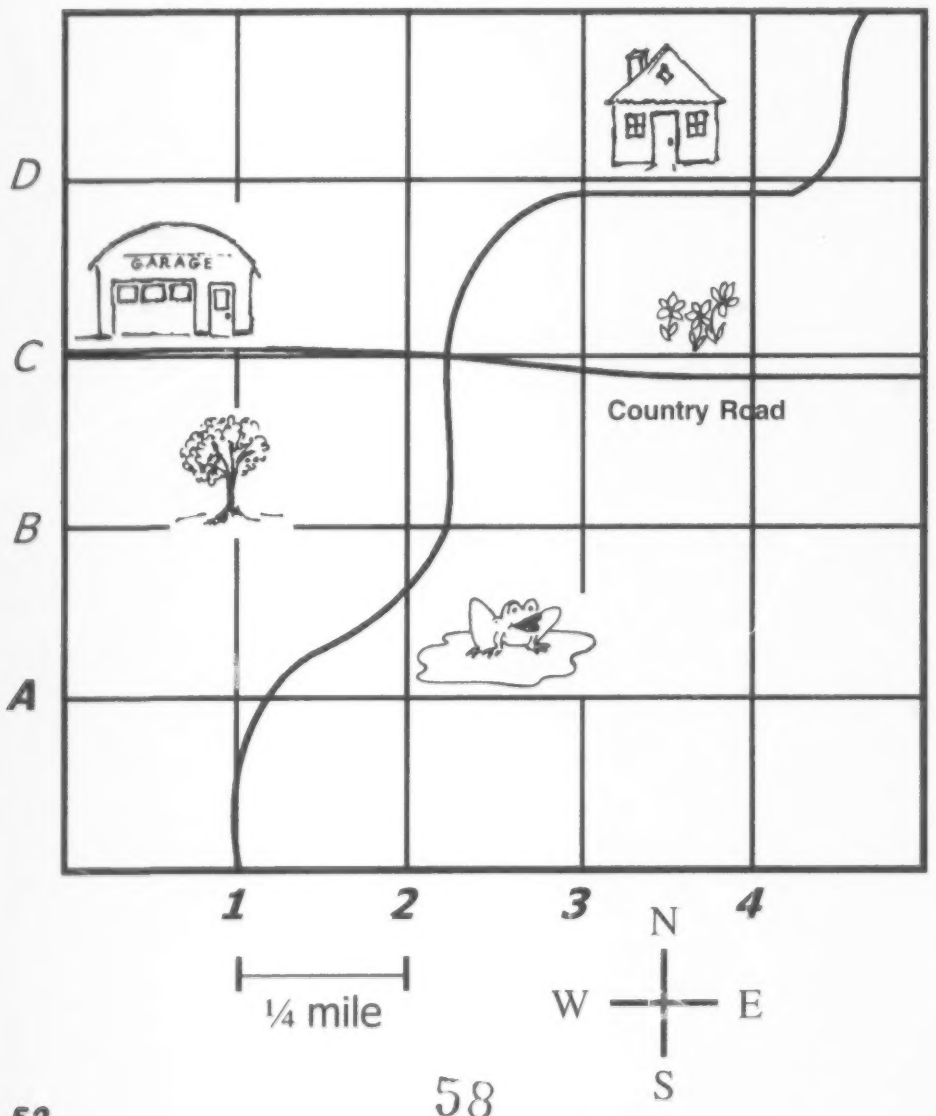


This is not quite a real map yet because it doesn't show any specific scale. For example, you can't tell how far it is from one landmark to another, and it would be hard to explain to another person what the relationships among the various features are. Later we will show how this simple drawing can be made into a real map.

A more accurate way to pinpoint the location of each landmark is to draw a grid of vertical and horizontal lines on the picture. This is a common way of locating specific points on maps. With large maps of the world or of countries, you'll often see (horizontal) latitude and (vertical) longitude lines. On a city map, the streets themselves may form a grid pattern. Sometimes grids are drawn onto maps, with an index to help the map user find a specific place.

Jim's neighborhood with grid

The next map has a grid which can be used to find specific points. Just read across the bottom until you reach the point you're looking for, and then follow that vertical line up until you get to the horizontal line you need. Here, as in the previous drawing, you are given compass directions. This map also tells that each segment on the grid stands for 1/4 mile. After studying the map, answer each of questions on the following page. Give the location of each landmark by specifying the letter on the vertical line followed by the number on the horizontal line (A-1, B-2, etc.).

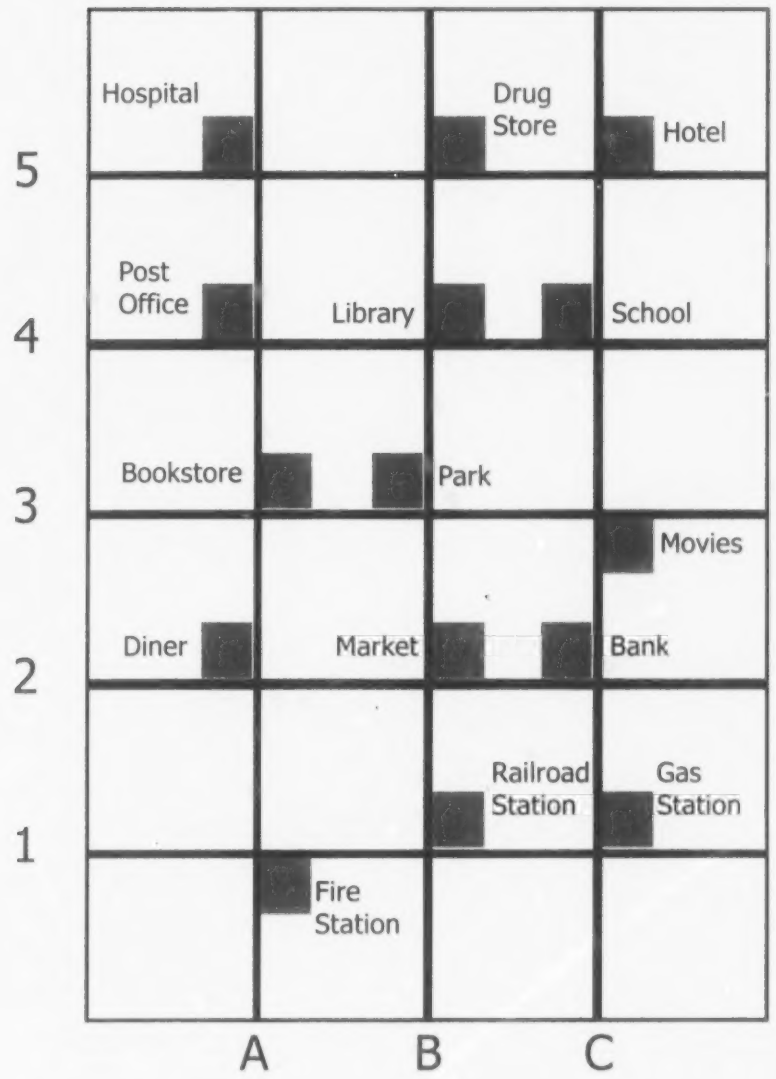


(1) Where is Jim's house on the map? (D-3)
(2) Where is the orchard? (A single tree, with its trunk on B-1, is used to represent all of the trees in the orchard located there.)
(3) The eastern end of the pond is shown on the map. How could you describe where it is? (A-3)
(4) While driving on the Country Road, we must turn off to get to Jim's house. This turnoff is near the intersection of which two grid lines? (C-2)
(5) Locate the garden and the gas station. (C-3, C-1) How far apart are they? (1/2 mile)
(6) How far is it from the gas station to the orchard? (1/4 mile)
(7) If Jim walked straight from his house to the edge of the pond marked at A-3, how far would he have to walk? (He'd go 3/4 mile, from D-3 to A-3.)

City center

The next map shows an area of 20 square blocks in the center of a small city. Here the grid is formed by streets laid out at right angles. Notice that this map is more abstract than the previous one was. Actual pictures of objects aren't included—only the names and locations of buildings.

MAP OF DOWNTOWN SOMEWHERESBURG



Study the map and then look at the questions that follow. Check back to find the letter and number that shows the location of each building.

(1) Post office: A - 4

(2) Hospital: A - __

(3) Fire station: __ - 1

(4) Park: __ - __

(5) Railroad station: __ - __

(6) Gas station:__ - __

(7) Drug store: __ - __

(8) Diner: __ - __

(9) School: __ - __

(10) Hotel: __ - __

(11) Bank: __ - __

(12) Library __ - __

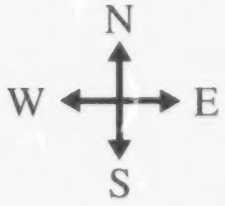
(13) Market: __ - __

(14) Bookstore: __ - __

(15) Movies: __ - __

United States Map

Find a map of the United States, with states clearly marked in contrasting colors. There may be such a map in one of your child's school books, or you can look in an encyclopedia or atlas to find one. Of course, it would also be good for your child to have a large map of the United States to put up on a wall. After studying the map, answer the following questions. (Pay particular attention to the *compass rose,* the crossed arrows that show North, South, East, and West.)



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(1) In which direction must you go to get from Oklahoma to Tennessee? (East)

(2) The borders of California are marked by an ocean, a foreign country, and three states. Name them. (Pacific Ocean, Mexico, Oregon, Nevada, Arizona)

(3) Which three states, other than California, border on Mexico? (Arizona, New Mexico, Texas)

(4) Name the five states in the western and central United States that share a border with Canada. (Washington, Idaho, Montana, North Dakota, Minnesota)

(5) Texas and Florida both border which body of water? (The Gulf of Mexico)

(6) Which state is directly north of Iowa? (Minnesota) Which state is just south of Iowa? (Missouri)

Tables

In tables, information is arranged (usually in columns) to show how a set of things relate. By knowing how to read a table, we can find facts quickly without having to read through a large amount of material.

All tables are labeled in some way to help the user find the needed information. A table has a title, telling what kind of information can be found in it, and each column has a heading that explains exactly what kinds of facts it contains. Look at the next two tables to see how information is arranged.

Care of house plants

The following table gives information on taking care of houseplants. Study the table and see what kind of information is given.

Care of House Plants

Type of plant	Watering instructions	Kind of soil
African Violet	Use lukewarm water. Keep soil uniformly moist.	Mixture of loam, sand, and humus.
Cactus	Wait until soil is dry. Water thoroughly.	Mixture of coarse sand and garden loam
Geranium	Wait until soil is dry. Water thoroughly.	Potting soil mixture
Gloxinia	Soil should be kept uniformly moist.	Open porous soil
Sansevieria	Water when soil is dry.	Open porous soil

As you see, the first column lists five different types of plants: African Violet, Cactus, etc. The second gives watering instructions for each plant, and the third column shows the kind of soil best suited for each one. If you want to know the best kind of soil for gloxinia, for example, simply find the name of the plant in the left column and follow across until you find the column showing the kind of soil.

Now answer the following True-False questions.

T F (1) Cactus needs soil made of coarse sand and loam.

T F (2) Gloxinia must be kept uniformly moist.

T F (3) African violets should be watered only when the soil is dry.

T F (4) Geraniums should be kept uniformly moist.

T F (5) Potting soil mixture is recommended for Sansevieria.

T F (6) Use a mixture of loam, sand and humus for African Violets.

T F (7) Use potting soil mixture for cactus.

U.S. Presidents

Our final table contains facts about ten of the U.S. presidents. As before, study the information given in each column and answer the questions that follow.

Ten U.S. Presidents

President	Home State *	Age #	Term
George Washington	Virginia	57	1789-1797
John Adams	Massachusetts	61	1797-1801
Thomas Jefferson	Virginia	57	1801-1809
John Quincy Adams	Massachusetts	57	1817-1825
Andrew Jackson	Tennessee	61	1829-1837
Abraham Lincoln	Illinois	52	1861-1865
Theodore Roosevelt	New York	42	1901-1909
Franklin D. Roosevelt	New York	51	1933-1945
Dwight D. Eisenhower	New York	62	1953-1961
John F. Kennedy	Massachusetts	43	1961-1963

* This is the state from which each president was elected, not necessarily the state in which he was born.

\# This is the age at inauguration.

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Now use the table to find the answer to each of these questions.

(1) Of the ten presidents listed here, which one was the youngest when he took office? (Theodore Roosevelt, who was 42)

(2) Which president in the group was oldest when he took office, and how old was he? (Dwight Eisenhower, 62)

(3) Which three presidents were living in Massachusetts when they were elected? (John Adams, John Quincy Adams, John F. Kennedy)

(4) How many of these presidents were elected during the nineteenth century (the 1800s), and who were they? (Four: Thomas Jefferson, John Quincy Adams, Andrew Jackson and Abraham Lincoln)

(5) Most of these presidents served for two full four-year terms. Which ones served for less than two terms? (John Adams, Abraham Lincoln and John F. Kennedy)

Summary

Your children will be following directions throughout their lives. Helping them learn to follow directions will make learning easier.

You can come up with a wide variety of activities to practice following both spoken and written directions. Use the samples in this chapter as starting exercises.

A good way to practice following directions is to work with graphs, maps, and tables. Ask your child to examine samples in this book and answer questions based on them. There are several kinds of graphs and charts. A little practice will help your child adjust quickly to finding information from each type.

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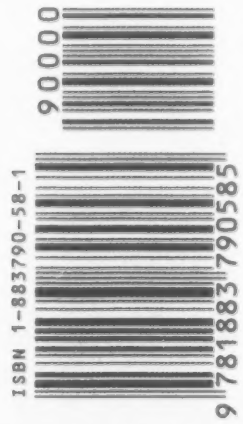

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